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A Relevance-Based Approach to Automatic Interpreting

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A Relevance-Based Approach to Automatic Interpreting

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Automatic Dialogue Interpreting

Automatic dialogue interpreting is a rather complex task. It requires a system that tackles the task of translating spontaneously spoken language in a face-to-face situation. [i] How can this interpreting task be described?

The system has to produce a target-language utterance that enables the hearer to infer the intended interpretation of the source-language utterance. In this view translation is regarded as an instance of communication in general. A basic assumption in **relevance theory** (Sperber, Wilson, 86) is that a speaker who communicates something has the intention to convey a set of assumptions to the hearer. In order to make the act of communication successful, the speaker should linguistically encode her assumptions in such a way that the hearer can reconstruct them with an adequate effort. According to the **principle of relevance** 'any utterance addressed to someone automatically conveys a presumption of its own relevance' (Wilson, Sperber, 88, p.140). The relevance of an assumption in a context depends on the one hand on its effects on this context and on the other hand on the required effort to process it in this context.

In a relevance-based approach to interpreting the **intended interpretation** serves as a translation invariant. A fundamental prerequisite of translation then is the derivation of the intended interpretation.

Especially for an input that is spontaneously spoken language the translation of an utterance should start from its intended interpretation. The problem with spontaneously spoken language is that 'the speaker's work of discourse production leaves traces in the utterance' (Gülich & Kotschi, 1994, p.31). Examples for these traces are on the one hand performance phenomena like repetitions, repairs, undue breaks and new starts, on the other hand phenomena like comments of the speaker on her formulating activities. Obviously all linguistic phrases that can be interpreted as traces of the speaker's work of discourse production cannot easily be rendered into target-language phrases as the hearer will be led to interpret them as traces of the interpreter's work of discourse production. Usually these

phenomena are to be smoothed out in the translation. Taking the intended interpretation as a translation invariant enables the system to decide which information to reduce in the translation. Another property of spoken language is its indeterminacy. As both speaker and hearer are present in the dialogue situation, all parts of an utterance referring to things given in the situation can be left linguistically underspecified. Spoken language contains many addressing and deictic pronouns and a lot of fragmentary or elliptical material. The decision whether to produce a translation that contains the same ambiguity as the original utterance mainly depends on the amount of information that is available to the hearer to whom the translation is addressed. Only those translations can be regarded as communicatively successful that enable the hearer to infer the originally intended interpretation.

From this perspective the problem of automatic dialogue interpreting boils down to the question how to automatically infer the intended interpretation of an utterance. For this we need a formal representation of the intended interpretation.

A Model of the Intended Interpretation

The semantic representation of a utterance can be taken as a starting point for its intended interpretation. It is derived by compositionally applying linguistic rules. In general the semantic representation is an incomplete logical form. Sperber and Wilson define a logical form as 'a well-formed formula, a structured set of constituents, which undergoes formal logical operations determined by its structure' (Sperber, Wilson, 86, p.72). Its incompleteness is reflected by the fact that it contains unbound variables, ambiguous expressions and elliptical material. Only after applying contextual processes that resolve these indeterminancies a complete logical form (or **explicature**) is derived.

There clearly are cases where an adequate translation of an utterance requires the derivation of its explicature. Typical examples are the translation of pronouns from German into English, as the gender of the referent decides on the translation of these pronouns. The pronoun *sie* in (1) can be either an addressing pronoun (2.sg., polite form), reflected by the translation in (2), or a personal pronoun (3.pl.) as translated in (3).

(1) ja gut, schlagen Sie einen Tag vor?

(2) Okay, please suggest a date.

(3) okay, are they suggesting a date?

Another case of ambiguity that can only be solved by drawing on contextual information is (4).

(4) Ginge es da bei Ihnen?

Depending on the preceding discourse this utterance can either be a proposal of a meeting place or a request to give a comment to a proposed date. The respective translations are given in (5) and (6).

(5) Shall we meet at your place?

(6) Is that allright with you?

Generally the intended interpretation of an utterance does not consist solely in an explicature but also in **implicatures.** The implicatures of an utterance are not systematically related to its linguistic properties, but are arrived at by further inferences. The hearer is only lead to derive implicatures if the explicature is not sufficiently relevant for her in the respective context. In the following part of a discourse the intended interpretation of (8) is (9) and (10).

(7) Can we meet next week?

(8) I will already be on holiday then.

(9) *We cannot meet when your are on holiday.*

(10) *We cannot meet next week.*

According to (Sperber & Wilson, 86) (9) is the implicated premise, (10) the implicated conclusion. The decision to express an utterance in such a way that its intended interpretation is an implicature relies on assumptions about the background knowledge of the hearer. The central question whether to express information explicitly or implicitly in the translation therefore depends on contextual knowledge, namely about assumptions on the hearers knowledge. The following turn from an appointment-scheduling dialogue demonstrates that sometimes implicatures depending on cultural context cannot be maintained in the translation without risking a failure of communication.

(11) Also ich bin gebürtiger Rheinländer, der Februar ist relativ stark besetzt, ich würde den Januar vorziehen. *(I am born in the Rheinland, February is rather full, I would prefer January*)

The relation between the fact of being born in the Rheinland and the fact that February is not a suitable time for a meeting can only be understood by taking into account that during February people in the Rheinland are busy celebrating carnival. An adequate translation has to either leave out this account or provide the hearer with the necessary information.

It should have become clear by now that the derivation of the intended interpretation heavily depends on contextual knowledge. This is the crucial point for automatic dialogue interpreting: contextual information in general cannot be made available to the system.
Therefore automatic dialogue interpreting seems not to be a manageable task for unrestricted contexts. In the remaining sections it will be demonstrated that, however, for a highly limited scenario there are ways to formally represent and compute the intended interpretations of utterances.

Modeling Intended Interpretations by Dialogue Acts

We start from the assumption that for a restricted scenario the set of intended interpretations is also restricted. As an example we take the appointment-scheduling domain, which is characterized by the following properties:

- The dialogue partners primarily focus on potential dates for appointments – hardly any other information is conveyed.
- The dialogue partners act cooperatively, they have a common goal, namely finding a date that suits both of them. They both try to gradually attain their goal.
- Their social relation is symmetrical.
- They do not know each other personally.

For this restricted domain a certain set of intended interpretations can be expected. The crucial question is how to model these interpretations. We propose a set of dialogue acts characteristic for this domain, which can be used to represent the intended interpretations. Dialogue acts are pragmatic-oriented abstract types of information, especially designed for the needs of dialogue processing. They allow us to represent utterances like *What about Thursday ?* and *I would suggest Thursday* by the same type, namely a proposal of a date, that has Thursday as its referent. Each type of dialogue act represents an illocution and a set of prototypical linguistic realizations. There are different classes of dialogue-act types**:**

- **purely-illocutionary** dialogue acts are completely specified by their name (e.g. greetings),
- **topic-dependent** dialogue acts contain besides the information specified above information about a referent that is a generic topic (e.g. initialization of an appointment scheduling dialogue act),

- **appointment-scheduling** dialogue acts are specified by the information specified above plus information about a concrete referent that is a date, a location or a duration, (e.g. suggesting a certain date)
- **propositional** dialogue acts contain additionally information about a proposition (e.g. introducing oneself).

For the type of appointment-scheduling dialogues investigated here the following types of dialogue acts are central:[ii]

init: The topic of the dialogue, i.e. arranging an appointment, is explicitly introduced. *Let's fix a time*.

suggest_date: A date is proposed. *Couldn't we say half past two then?*

reject_date: A proposal of a date is rejected. *That's not so good*.

accept_date: A proposed date is accepted. *Yes a quarter to three would suit me fine.*

give_reason: An explanation for an acceptance, a declination or a proposal of a date is given. *I'll still be away in Majorca.*

request_suggest: The dialogue partner is asked to make a proposal. *When would it suit you?*

request_comment: The dialogue partner is asked to comment on a proposed date: *Would that suit you?*

As these dialogue acts represent intended interpretations of utterances, they can be used as a translation invariant. This is demonstrated by the following part of an appointment-scheduling dialogue:

A: ja, ich würde vorschlagen, wir legen zuerst das Treffen in Stockholm fest (*yes, I would suggest, we fix the meeting in Stockholm first),* **[init_date, topic: meeting in Stockholm]** und zwar würde ich da gerne Montag, den vierzehnten März mich mit Ihnen in Stockholm treffen. *(and I would like to meet you on Monday, the 14th of March in Stockholm)* **[suggest_ date, date: Monday, the 14th of March]**

B: das würde nicht passen, *(that would not suit me)* **[reject_date]**

The automatic interpreting is composed in two steps, first for each utterance its dialogue act is inferred, then the resulting dialogue act is handed over to the generation component, and finally the respective dialogue act is verbalized in the target language. A description of the procedure that is actually used to compute for an utterance its intended dialogue act is given in (Schmitz, Quantz, 94).

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[i] The interactive task of maintaining the dialogue as a special participant will be neglected here.

[ii] A detailed description of the set of dialogue acts that are currently implemented in our system is given in (Jekat et al., 95).